Application Interface Services

Description

Application Interface Services (APIS) is a real-time message-oriented middleware (R-T MOM) for the implementation of self-learning and self-healing mission-critical distributed systems. As such it is an extended profile network communications protocol designed for the exchange of information between functionally-independent applications incorporated in a distributed real-time system. APIS is a Data Distribution Service (DDS) according to the Object Management Group (OMG) standard.

APIs conceptually encompasses Layers 5 to 7 of the ISO Open Systems Interconnection (OSI) Reference Model and so interfaces Layer 4 (the Transport Layer) and below to the Application Service User (ASU). The ASU will normally be a collaborative, networked, software-based application.

The ASU is a publisher and/or subscriber of data of different types. The APIS protocol establishes the necessary communication channels between ASUs by registering and matching their publishers and subscribers. LAN dataflow will therefore be determined by the data type of ASU messages and not by predefined ASU addresses. This data-driven approach to dataflow management provides a higher level of flexibility than the traditional addressed point-to-point facilities provided by general purpose LAN protocols.

APIs also provides various Quality of Service (QoS) and Security features such as advanced Virtual LAN (VLAN) and Precision Time Protocol (PTP) capabilities, making it a fully featured data transfer package ideal for real-time distributed systems. An in-depth administration and monitoring software tool forms part of APIS providing for further reliability and robustness.

Features

- Built-In Test Services (BITS) for network monitoring
- Networks Time Services (NTS)
- decentralised system for peer-to-peer communication
- full Application Programming Interface (API) for rapid system integration
- compatible with multiple transports (10 Gigabit Ethernet, Gigabit Ethernet, etc)
- automatic discovery for self-learning and self-healing capabilities
- supports advanced VLAN capability (IEEE 802.1Q VLAN and GVRP protocol) to ease network planning
- software based IEEE 1588 PTPv2 (Precision Time Protocol) for time synchronisation of networks
- redundant Gigabit Turbo Ring and Turbo Chain
- QoS (IEEE 802.1p/1Q and TOS/DiffServ) to enhance determinism
- bandwidth management to prevent unpredictable network status
- port locking functionality for blocking unauthorised access based on MAC address
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Principles of Operation

Message classification characterises each message by type, sub-type and identifier (ID). Messages are then grouped by type and sub-type and uniquely identified by Message ID. Such classification is made on the basis of origin (i.e. publisher) and application category (e.g. contact, target, navigation data, etc.).

Publishers and subscribers register with their own (local) APIS which identifies them to the system by means of an APIS broadcast. The status of all publishers and subscribers is then maintained in a local status table which is updated periodically as well as at each significant status event. The aggregate of this process provides a distributed, real-time, dataflow management agent.

When a subscriber requires a message it registers its requirement (i.e. demands the message) and APIS sets up all necessary internal mechanisms and control messages to ensure that the publisher provides this message.

The Message Identification scheme is designed in such a way as to support wildcarding. Wildcarding is defined as group addressing by means of address subsets. Thus groups of publishers and subscribers can be accessed using a generic addressing scheme. APIS employs wildcarding to manage production and consumption of messages, both individually as well as by group (type) and sub-group (sub-type). Wildcard demand and limited wildcard produce are both supported as APIS service options.

Performance

- < 50 µs APIS layer transition (< 200 byte messages)
- < 950 µs end-to-end latency (< 200 byte messages)
- > 900 Mbit/s end-to-end throughput (> 4 000 byte messages) over 1 Gigabit Ethernet
- > 9 Gbit/s end-to-end throughput (> 4 000 byte messages) over 10 Gigabit Ethernet

Operating System Support

- VxWorks V6.x
- VxWorks V7.x
- Linux Kernel V3.x
- Windows

Applicable Standards

- IEEE 802.3x for Flow Control
- IEEE 802.1D-2004 for Spanning Tree Protocol
- IEEE 802.1w for Rapid Spanning Tree Protocol
- IEEE 802.1s for Multiple Spanning Tree Protocol
- IEEE 802.1Q for VLAN Tagging
- IEEE 802.1p for Class of Service
- IEEE 802.1X for Authentication
- IEEE 802.3ad for Port Trunk with LACP